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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/887,490	06/22/2001	Lior Ophir	TI-30916	7722

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TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER	
AHN, SAM K	

ART UNIT	PAPER NUMBER
2637	

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/887,490	OPHIR ET AL.	
	Examiner	Art Unit	
	Sam K. Ahn	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *amendment, 01/21/05*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,12-17,26-28,38,39 and 45* is/are rejected.

7)☒ Claim(s) *6-11,18-25,29-37,40-44 and 46-48* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 01/21/05 have been fully considered but they are not persuasive. On page 15, applicants argue that claims 1, 26 and 45 have been amended to include the limitations identified by the examiner as being allowable. The examiner respectfully disagrees. The Office Action, paper no. 101504, explains that "the partitioned symbol sequence having three parts with the limitations as recited" are allowable. Thus, the allowable limitations include processing the first and second part of the desired symbol sequence via shell mapper and TTCM encoder, respectively, and mapping third part to generate N transmit symbols. The amended claims are rejected as below.

Claim Objections

2. Claim 38 is objected to because of the following informalities:

   In claim 38, it appears that the claim should depend on claim 33, since claim 38 recites "the trellis precoder". Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4,12-17,26-28,38 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eyuboglu (cited previously) in view of Gelblum et al. USP, 6,088,387 (Gelblum, cited previously) and Forney, Jr. et al. USP 5,150,381 (Forney).

Regarding claims 1, 26 and 28, Eyuboglu teaches a method and apparatus of binary coded data communication, the method comprising the steps of providing a transmitter having a trellis coded modulator (TCM) encoder and constellation shaping elements, a receiver having a receiver turbo decoder, and receiver constellation shaping elements (see Fig.6); and generating a plurality of signal points in response to a partitioned binary coded symbol sequence that is processed via the TCM encoder and constellation shaping elements (see Fig.5 and note p.303-305). However, Eyuboglu does not teach wherein the trellis coded modulator is a turbo trellis coded modulator.

Gelblum teaches combining turbo codes with a trellis code modulation and discloses a turbo-trellis code modulation (TTCM) (see Fig.1). And further teaches that TTCM achieves low bit error rate (BER). (note col.1, line 13 – col.2, line 62) Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Eyuboglu's TCM with TTCM for the purpose of achieving a higher BER, and furthermore, TCM and TTCM belong to same family of trellis modulation.

However, Eyuboglu in view of Gelblum do not explicitly teach wherein the partitioned symbol sequence comprises a first part having K-bits, a second part

having N*k – bits, and a third part having the remaining bits and wherein K and N are integers.

Forney teaches, in the same field of endeavor, wherein the partitioned symbol sequence (see Fig.13) comprises a first part having K-bits (3 bits), a second part having N*k – bits (1*3), and a third part having the remaining bits (2m) and wherein K and N are integers. Therefore, it would have been obvious to one skilled in the art at the time of the invention to input the partitioned symbol sequence in the system of Eyuboglu in view of Gelblum for the purpose of having a bit structure to support Wei code, which has a good practical characteristics and achieving a good shaping gain, as taught by Forney (note col.26, lines 49-65 and note col.27, line 48-54).

Regarding claim 45, Eyuboglu teaches a method and apparatus of binary coded data communication, the method comprising the steps of providing a transmitter having a trellis coded modulator (TCM) encoder and constellation shaping elements, a receiver having a receiver turbo decoder, and receiver constellation shaping elements (see Fig.6); and generating a plurality of signal points in response to a partitioned binary coded symbol sequence that is processed via the TCM encoder and constellation shaping elements. (see Fig.5 and note p.303-305) Eyuboglu further teaches providing a receiver having a turbo decoder and constellation shaping elements, and processing the plurality of signal points via the receiver turbo decoder and the receiver constellation shaping elements to

recover the partitioned symbol sequence. (see Fig.6 and note p.304 having a nonuniform probability distribution)

However, Eyuboglu does not teach wherein the trellis coded modulator is a turbo trellis coded modulator. Gelblum teaches combining turbo codes with a trellis code modulation and discloses a turbo-trellis code modulation (TTCM) (see Fig.1). And further teaches that TTCM achieves low bit error rate (BER). (note col.1, line 13 – col.2, line 62) Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Eyuboglu's TCM with TTCM for the purpose of achieving a higher BER, and furthermore, TCM and TTCM belong to same family of trellis modulation.

However, Eyuboglu in view of Gelblum do not explicitly teach wherein the partitioned symbol sequence comprises a first part having K-bits, a second part having N*k – bits, and a third part having the remaining bits and wherein K and N are integers.

Forney teaches, in the same field of endeavor, wherein the partitioned symbol sequence (see Fig.13) comprises a first part having K-bits (3 bits), a second part having N*k – bits (1*3), and a third part having the remaining bits (2m) and wherein K and N are integers. Therefore, it would have been obvious to one skilled in the art at the time of the invention to input the partitioned symbol sequence in the system of Eyuboglu in view of Gelblum for the purpose of having a bit structure to support Wei code, which has a good practical characteristics

and achieving a good shaping gain, as taught by Forney (note col.26, lines 49-65 and note col.27, line 48-54).

Regarding claim 2, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 1. Eyuboglu further teaches wherein the step of generating a plurality of signal points in response to a partitioned binary coded symbol sequence that is processed via the TTCM encoder and constellation shaping elements comprises the step of generating a signal constellation having square shaping regions (see Fig.4) capable of use in association with trellis shaping that is compatible with rate kc/nc TTCM, such that a binary kc -tuple portion of a desired symbol sequence can be processed via the TTCM encoder for a rate kc/nc TTCM code to generate a nc -tuple.

Regarding claim 3, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 1. Eyuboglu further teaches wherein the step of generating a plurality of signal points in response to a partitioned binary coded symbol sequence that is processed via the TTCM encoder and constellation spherical elements comprises the step of generating a signal constellation having square shaping regions capable of use in association with trellis shaping that is compatible with rate kc/nc TTCM, such that a binary kc -tuple portion of a desired symbol sequence can be processed via the TTCM encoder for a rate kc/nc TTCM code to generate a nc -tuple. (see Fig.14 and note p.311)

Regarding claim 4, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 1. Eyuboglu further teaches wherein the step of providing a transmitter having a turbo trellis coded modulator (TTCM) encoder and constellation shaping elements comprises the step of providing trellis precoding elements and TH-precoding elements capable of use with non-square constellations. (see Fig.8 and note p.306-308)

Regarding claim 12, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 1. Eyuboglu further teaches the step of processing the plurality of siral points via a trellis precoder to generate a coded symbol sequence. (see Fig.7 and 8)

Regarding claims 13,14 and 27, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 12 or 26. Eyuboglu further teaches providing a receiver having a turbo decoder and constellation shaping elements, and processing the plurality of signal points via the receiver turbo decoder and the receiver constellation shaping elements to recover the partitioned symbol sequence. (see Fig.6 and note p.304 having a nonuniform probability distribution)

Regarding claim 15, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 12. Eyuboglu further teaches wherein the step of processing the plurality of signal points via the receiver turbo decoder and the receiver constellation shaping elements comprises the steps of: folding the coded symbol sequence to generate a folded constellation (see Folding in Fig.9); processing the folded constellation via the turbo decoder to generate estimated signal points (see Decoder in Fig.9); and processing the estimated signal points via an inverse mapper to generate an estimated binary kc -tuple part of the desired bit sequence according to the rate kc/nc TTCM code, an estimated uncoded binary nu -tuple part of the desired symbol sequence, and an estimated binary rs -tuple part of the desired bit sequence according to the rate ks/ns convolutional shaping code. (see Fig.6)

Regarding claims 16 and 17, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 15. Eyuboglu further teaches wherein the step of processing the plurality of signal points via the receiver turbo decoder and the receiver constellation shaping elements further comprises the step of processing the estimated binary kc -tuple part of the desired bit sequence according to the rate kcjnc TTCM code to recover k bits based on n bits and to generate an estimated binary kc -tuple part of the desired symbol sequence, and the step of processing the estimated binary rs -tuple part of the desired bit

sequence according to the rate ks/ns convolutional shaping code to generate an estimated syndrome rs -tuple part of the desired spnbol sequence. (see Fig.6)

Regarding claim 38, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 28. Eyuboglu further teaches wherein the trellis precoder comprises a Tomlinson-Harashima precoder. (note p.305)

4. Claims 5 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eyuboglu (cited no.CE in the IDS) in view of Gelblum et al. USP, 6,088,387 (Gelblum) and in further view of Forney, Jr. et al. USP 5,150,381 (Forney) and Khandani (Shaping of Multi-dimensional Signal Constellations Using a Lookup Table), IEEE.

Regarding claims 5 and 39, Eyuboglu in view of Gelblum and Forney teach all subject matter claimed, as applied to claim 1 or 26. Eyuboglu in view of Gelblum further teaches wherein the step of generating a plurality of signal points in response to a partitioned binary coded symbol sequence that is processes via the TTCM encoder and constellation shaping elements, however, do not explicitly teach partitioning a signal constellation into cosets and shells in compliance with shell mapping and TTCM. Khandani teaches teach partitioning a signal constellation into cosets and shells in compliance with shell mapping and TCM. (see Fig.1 and note p.0927-0928) Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Eyuboglu's system by

replacing Eyuboglu's constellation shaping elements with a shell mapper of Khandani for the purpose of increasing average energy, as taught by Khandani (note p.0928).

Allowable Subject Matter

5. Claims 6-11, 18-25, 29-37,40-44 and 46-48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and overcome the claim objections.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sam Ahn whose telephone number is (571) 272-3044. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sam K. Ahn
6/12/05

TEMESGHEN GHEBRETINSAE
PRIMARY EXAMINER
6/21/05